

Depositional Process - Fabric - Pore: Conceptualizing the Connection between Depositional Regime, Pore Types, and Porosity in Mudstones

Juergen Schieber

Indiana University, Bloomington, IN

Abstract

The rock record is dominated by shales and mudstones, but the understanding of the processes by which these sediments are transported and deposited is changing in significant ways. Whereas quiet settling in low energy environments used to be the “conventional” perspective, we know now, for example, that muds can accumulate as floccules in bedload at flow velocities that would suffice for bedload transport of sand. Insights like these suggest that the geologic record of mudstones is in urgent need for re-examination, and that with further experimental work we may eventually arrive at a comprehensive understanding of mudstone sedimentology. A higher level of understanding fine grained sediments is the “next step” for making meaningful progress in the study of basin fills, climate archives, and energy resources.

Flume studies provide a physical basis for interpreting sedimentary structures in shales, and that in turn leads to greatly improved EOD assessment in shale successions. As shale fabrics become meaningful, it also becomes apparent that depositional mode has a direct impact on the developing sedimentary fabric, shale microstructure, and initial pore development. High resolution petrography shows that primary pore structures may partially survive burial and can be critical to the permeability and producibility of unconventional reservoirs. In that context, flume studies not only open up new avenues of inquiry for depositional processes and microfabrics, but also provide alternative scenarios of carbon burial and the origin of unconventional hydrocarbon resources.

Shale studies will be a Focus of sedimentary geology research for the foreseeable future. We have decades of work ahead of us.

